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This study explores the adoption of open innovation (OI) practices in medium-sized and large firms in a sector characterised by low levels of external collaborations. Many firms struggle to adopt OI practices (O'Connell, 2011); the processes that lead to the adoption of OI practices are unclear (Mortara and Minshall, 2011); and the degree of open innovation, as measured by the number of external collaborations, in Irish firms is low (Vahter et al., 2012). This inductive study is based on case studies of a significant innovation in four medium-sized (€50m to €500m) and four large (Revenue above €500m) firms from the food sector in Ireland. In each of the firms, multiple senior managers (CEOs, innovation managers and marketing managers) were interviewed about the origin of the innovative idea; the management of the innovation; and the role of external partners and customers in the innovation process. Within and cross case analysis finds that the adoption of OI innovation practices are most common at the early stage of the innovation value chain (IVC); that managerial perceptions of competitive threats appear to limit the extent to which firms adopt OI practices at the conversion stage of the IVC; that at the diffusion stage OI practices are largely limited to collaborations with customers; and managers regard external interactions for market orientation as being open in their innovation processes. In terms of the process of adoption, the smaller firms in this study are characterised by ad-hoc adoption of OI practices, while in the larger firms there is some evidence of more 'conscious adoption' of OI practices (Mortara and Minshall, 2011). Contributions include an argument that OI practices differ by stages of the innovation process; that managerial perceptions limit the adoption of OI practices; that market orientation may be regarded as a subset of open innovation; and the development of emerging work that explores the adoption of OI in non-'high-tech' contexts.

1. Introduction

Open innovation (OI) is referred to as the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively (Chesbrough, 2003b). As an emerging innovation management paradigm, OI is a way to enhance the innovation capabilities of the practicing firms. While the positive outcomes of practicing OI are widely acknowledged, research on the adoption of OI is still emerging (Enkel et al., 2009) ; (Van de Vrande et al., 2009), but to date the scope of this research has been limited. There are only a very few studies examining the 'process that leads to open innovation' (Huizingh, 2011).

Understanding the adoption of open innovation needs to be combined with the innovation activities of a firm. Hansen and Birkinshaw (2007) argue that the process of transformation of the ideas into commercial output must be viewed as an integrated flow - innovation value chain (IVC). They also indicate that a link by link analysis helps identifying the different strong and weak links in the process and thereby improving overall innovation efforts. Similarly OI practices may also differ by stage of a firm's

IVC. Doran and O'Leary (2011) suggest that the IVC framework facilitates the analysis of inter-relationships between external interaction and innovation as it highlights the structure and complexity of the innovation process. Because knowledge, of different types and from varying sources, is the uniting aspect providing the main functional link between the different aspects of the innovation value chain (Roper, 2008), the IVC framework can be a useful tool in exploring the adoption of OI practices. Therefore, firstly this study aims to explore the adoption and nature of OI practices across the different stages of the innovation value chain.

Additionally, with regard to the adoption of OI, little research has studied the perceptions managers have about adopting the practices (Morgan and Finnegan, 2010); (Henttonen et al., 2012).While research studies highlight the importance of how perceptions could influence the adoption of an innovation (Geroski, 2000), little research focused on if managerial perceptions specifically impact on the adoption of OI.

Considering that strategic choices are often shaped by the market conditions (Chesbrough, 2003a); (Rigby and Zook, 2002), and market orientation behaviours are associated with innovation practices (Agarwal et al., 2003), the market oriented frame of mind of managers for OI adoption is also explored. The present study therefore also analyses if adoption of OI practices is impacted by managerial perceptions.

In an Irish context innovation output (Jordan and O'Leary, 2008); knowledge transformation (Roper, 2001) and innovation value creation (Roper, 2008) has been explored using the IVC. This paper adds to the literature by systematically analysing the three stages of the IVC separately for OI adoption and for managerial perceptions influencing the extent and nature of these practices, in the food sector in Ireland.

The paper is structured as follows: Section 2 reviews the relevant literature on the adoption of open innovation, with a focus on the innovation value chain. Section 3 describes the research design and how the data was collected and analysed. Section 4 presents the results of the empirical analysis, while Section 5 discusses the findings and concludes by outlining the contributions, limitations of the study and future avenues for research.

2. Literature review

The concept of OI is fast emerging as a key determinant of competitive advantage in technology development (Chesbrough, 2003b); (Chesbrough and Crowther, 2006). While research on OI spans across several industries (Gassmann et al., 2010), studies on the adoption of OI practices are still emerging (Enkel et al., 2009); (Van de Vrande et al., 2009). Gassman et al. (2010) suggests that the adoption often starts with outsourcing to contract service organizations and more strategic modes of execution then follow. Barrett et al. (2011) argue that it involves three major challenges for a firm, namely, ensuring that it is ready to open up, building trust among partners and putting together a business model for mutually rewarding relationships. They further suggest that to enable opening up firms must pursue preparations to collaborate with partners like developing internal capacities, technology infrastructure to support innovation, mechanism to access upcoming opportunities and partners' ideas and ability to convert these into valuable products. Research's focus however has been on adoption of OI in high tech industries such as electronics (Christensen et al., 2005), telecommunications (Ferrary, 2011) and pharmaceutical (Melese et al., 2009); (Bianchi et al., 2011).

Literature suggests that OI is not led by any one type of firm and indicates its adoption by both large and small firms. In case of large firms most of the studies detail single firm examples of implementation of OI practices, like those initially presented by Chesbrough (2003b) of Lucent, IBM, Intel and Millennium Pharmaceutical, that of DSM (Kirschbaum, 2005), P&G (Dodgson et al., 2006; Huston and Sakkab, 2006) and ItalCementi (Chiaroni et al., 2011). Quantitative studies on OI implementation include Lichtenthaler (2008), Lichtenthaler (2009) and Keupp and Gassmann (2009) however, in spite of the potential benefits of qualitative cross firm analysis (Eisenhardt, 1989), there is limited research of this kind (Mortara and Minshall 2011). Some examples though include, Chesbrough and Crowther (2006), Chiaroni et al. (2010), Ferrary (2011) and Bianchi et al. (2011). These studies highlight that the process of OI implementation is far from being smooth and continuous and the processes that lead to the adoption of OI practices are unclear (Mortara and Minshall 2011).

Kline and Rosenberg (1986) argue that, "Innovation is complex, uncertain, somewhat disorderly and subject to changes of many sorts. Innovation is also difficult to measure and demands close coordination of adequate technical knowledge and excellent market judgement in order to satisfy economic, technological and other types of constraints – all simultaneously. The process of innovation must be viewed as a series of changes in a complete system" (1986: 275).

The innovation value chain captures this systemic nature of the innovation process and highlights its structure and complexity (Doran and O'Leary 2011). While the current literature explores the journey from closed to open innovation (Chiaroni et al., 2011); similar to understanding innovation practices at distinct stages, the IVC framework can provide a useful tool to explore OI adoption at different steps of the innovation process.

Hansen and Birkinshaw's (2007) innovation value chain framework is a "sequential, three-phase process that involves idea generation, idea development, and the diffusion of developed concepts" (p. 122). The first stage involves firms' efforts to gather all necessary knowledge for innovation. These knowledge sources can be both internal and external to the firm, acting as complements or substitutes to one another (Audretsch et al., 1996). Cassiman and Veugelers (2002) indicate a complementary relationship between internal and external knowledge sourcing, while Schmidt (2005) suggest a substituting relationship between internal R&D and external knowledge sourcing. This stage of the innovation value chain has been researched in part or in full by Jordan and O'Leary (2008), Love and Roper (2001) and Roper et al., (2008) in an Irish context and they argue a

complementary relationship between the two knowledge sources.

The second stage involves transforming knowledge into innovation output like new products, processes or organizational forms. Firms may use multi-skilled internal teams or different forms of external partners when developing new innovations. The framework in the development stage also captures organizational and marketing activities. Analysing how firms generate innovative output using an innovation production function approach, Roper (2001), Love and Roper (2001) and Jordan and O'Leary (2008) find that that both R&D and external interaction have a positive effect on the possibility of product innovation. Also, Roper (2001) in case of Irish manufacturing plants suggested that networking played an important part in determining the likelihood of the plant being innovative.

The final stage of the innovation value chain involves the process of exploitation by which the innovation outputs are translated into productivity or sales gains. Analysing this stage, Roper et al., (2008) find that a firms' performance is positively impacted by innovation output. Extending Roper's (2008) work Doran and O'Leary (2011) explore potential feedback effects on firms' performance and innovation output and outline that together with productivity being affected by innovation output, feedback from market and other sources may also influence the innovation output of a business.

In order to describe the adoption of OI, using the IVC framework, the study aims to explore how OI practices differ by stages of the IVC and how managerial perceptions including market orientation influence it, in an Irish context.

3. Research methodology

The multi-method study uses data from two sources. Firstly EUROSTAT Community Innovation Survey (CIS) data for Ireland for 2008-2010 was used to describe extent of open innovation practices in Irish firms. Secondly multiple case studies of a significant innovation in four medium-sized (Revenue €50m to €500m) and four large (Revenue above €500m) firms from the food sector in Ireland were conducted to explore the adoption of the OI practices.

CIS data

The CIS 2008-2010 is a survey of innovation activities of enterprises in Ireland and other EU Member States. The survey collects information about product, process, organisational and marketing innovation and other key variables.

The CIS 2008 for Ireland was jointly conducted by the Central Statistics Office (CSO) and Forfás (Ireland's national policy advisory body) and comprised of 2,178 firms, categorised in sectors with sub-classifications under each heading. The sectoral classification included-manufacturing, wholesale and retail, transportation and storage, information and communication, financial and insurance activities and scientific and technical activities.

Measures and data analysis

The Irish CIS 2008 data was analysed to measure the percentage of firms engaging in innovation activities (for e.g. outputs like product, process, marketing innovation etc. or processes like purchasing or licencing external knowledge). *Innovation output* of the firms was measured as a percentage of the sum of a firms' turnover from new to market products and turnover of new to firm products while their *R&D intensity* was measured as firms' innovation expenditure divided by the firms' turnover. The firms' *co-operation breadth* was measured using the number of the different types of domestic and foreign co-operation partners firms' use in their innovation process (e.g., other enterprises within own group, suppliers, competitors, customers, consultants, universities or government institutes). The co-operation breadth could thus range from 1-7. Firms having 1-3 partners were categorised as having low co-operation breadth while those with 4-7 partners had a high co-operation breadth. The percentage of firms having high or low co-operation breadth was also measured.

The extent of openness score for the firms was measured in the following manner:

$$EO_i = EEI_{ji} + \sum_{j=1}^{7} DC_{ji} + \sum_{j=1}^{7} FC_{ji}$$

Where:

EO_i	Extent of openness of firm i
EEI_{ji}	Engagement in external interaction which includes purchasing or licencing external knowledge
DC_{ji}	Domestic collaborations
FC_{ji}	Foreign collaborations
J	Partners including other enterprise within own enterprise group, suppliers, customers, competitors, consultants, universities and government or public research institutes

Based on the above calculation, the extent of openness score of a firm could range from 0 to 15, implying that firms with count 0 do not adopt any OI practices while firms with count up to 15 have high degree of openness.

Multiple case study approach

This research explores the research question inductively and for the empirical investigation case study research was the chosen methodological approach. Guided by scholars' suggestion that it is an appropriate tool for building rich understanding of a complex phenomenon (Eisenhardt and Graebner, 2007) that needs the competence to answer 'how' and 'why' questions (Yin, 2009), the choice of case study approach was made. We focused on multiple case-study design as it allows identification of similar themes as well as variations across cases along with the examination of individual cases.

The interview data was analysed using the template analysis approach. Firstly, a coding template was developed summarizing themes identified from a preliminary reading of the interview transcripts. The IVC framework also defined the template structure, as it comprises an end to end view of the innovation activities

involved in the process, namely: accessing and creating knowledge, building innovation and commercializing those innovations (NESTA, 2009). Broad themes in the template include successively narrower, more specific ones. The data was then read through to code priori themes, themes that were strongly expected to be relevant to the analysis. After this initial coding, new themes if recognised were defined to include the appropriate material and arranged into the initial template. This initial template was then applied to the whole data set, and altered in the light of consideration of each transcript. The template served as the basis for interpretation of the data set, and for the writing-up of the findings.

Interview data

With a need to focus OI adoption research in a non-high tech sector as outlined above, Ireland's main indigenous industry, the manufacturing of food and drink products was chosen for the current study. An initial list of the Irish food firms with a minimum annual turnover of 50 million was then prepared. Exemplars of innovative firms were identified using the Lexis-Nexis newspaper database (www.lexisnexis.com), using search keywords related to innovation and open innovation. In a second round of screening multinationals, European, UK or Northern Ireland firms were excluded to have the list of only Irish firms. This selection criterion was informed by our pilot study which indicated that the Irish subsidiary firms had limited information and decision making abilities with regard to the innovations the firms did. Firms that were only distributors of food products and meat firms were not included.

The list thus comprised of 22 firms all of which were contacted for the study. An initial round of formal letters were sent out requesting the firms for participation in the research project followed by repeated rounds of emails and phone follow- ups. 8 out of the 22 firms agreed for participation, these were then grouped as medium-sized (€85m to €300m) and large (716m - €5,800m) firms, four falling in each category. Interviews with multiple senior managers in the 8 firms were conducted face-to-face or, in one instance by telephone in 2013. The interviewees were senior in that they had roles such as CEO, R&D Manager, Marketing Manager or Innovation Manager.

The semi structured interviews were framed around the concepts reviewed in the literature. The interviews comprised of two elements. First, the participants were asked to identify a significant innovation that has occurred in their organization. The first section of the interview focused on gathering information about this innovation in terms of how it occurred, was developed and implemented, how it was managed and how exchange/flow of knowledge occurred with internal as well as parties external to the organization. The second section of the interview focused on getting information more generally about how the firm managed and measured the effectiveness of its innovation. The interviews lasted about 60-90 minutes each. The 18 interviews were recorded and transcribed. Additional information about the firms was collected from the company websites and press releases.

4. Research findings

We analysed the CIS 2008 data for innovation in Ireland with a particular focus on the food sector and on the collaborations firms' engage in when innovating. In order to delve deeper into the adoption of the OI paradigm we then analyse interviews about a significant innovation conducted in 8 firms from the food sector in Ireland.

Dataset analysis

Of the sample of 2178 firms in Ireland, 32.4% firms engage in internal R&D activities while 14.1% in external R&D. Most firms regard improving the quality of their goods and services as the key objective for pursuing innovation. With an average innovation output of 7% and R&D intensity of 21% more firms in Ireland tend to practice environmental innovation (45.8% firms) as against other types of innovations like, process innovation (44.4% firms), organizational innovation (42.4% firms), marketing and product innovations (36.3%).

With regard to collaborating with external partners for innovation purposes, the average extent of openness of firms in Ireland is 0.79. Most firms have a low co-operation breadth. 68.7% firms collaborate with 1-3 external partners, while 31.3% firms engage with 4-7 partners. Majority of firms collaborate with their suppliers (59.2% firms) followed by their customers (53.4% firms).

Focusing on sectors, more firms in the food sector practice internal and external R&D than any other sector; of the sample of 132 food firms 57.4% performed internal R&D, while 22.7% engaged in external R&D. Environmental innovation was their most practiced type of innovation (65.2%), followed by process and product innovation (63.6% and 51.5% respectively) and marketing and organizational innovations (47.7%). The number of firms performing product, marketing and organizational innovation is higher in one other sector compared to food, the information and communications sector, where out of 180 firms, 55% report product innovation, 52.8% organizational and 51.7% marketing innovation.

The food sector has an average innovation output of 10%, the second highest. The information and communications sector is highest at 17%. R&D intensity of the food sector is 2%, lagging behind many other sectors including information and communications sector (91%), scientific and technical activities (29%) and wholesale and retail trade (9%). With regard to co-operation breadth for innovation activities, 59.5% food firms collaborate with 1-3 partners while 40.5% firms collaborate with 4-7 partners. More food firms tend to have a higher co-operation breadth when practicing process and organizational innovations than with other types of innovations. The sectors' extent of openness averages at 1.44, however the key collaborators in case of food sector as in most other cases like wholesale and retail trade, transportation and storage, information and communication, financial and insurance and scientific and technical activities remain suppliers and customers with 67.6% and 56.8% food firms engaging with them respectively. The results from CIS data are summarized in Table 1.

Table 1. CIS data summary

Sector	Average innovation output[a] (%)	Average R&D intensity[b] (%)	Average extent of openness	Co-operation Breadth[c]		% Firms carrying out innovation activities							
				% of Firms with 1-3 partner	% of Firms with 4-7 partner	Product Innovation	Process Innovation	Marketing Innovation	Organizational Innovation	Environmental Innovation	Internal R&D	External R&D	Purchase / Licence external knowledge
All Irish Firms (n=294-2178)	7	21	0.79	68.7	31.3	36.3	44.4	36.3	42.4	45.8	32.4	14.1	8.5
Food, Beverage and Tobacco (n=37-132)	10	2	1.44	59.5	40.5	51.5	63.6	47.7	47.7	65.2	57.4	22.7	7.2
Manufacturing (n=100-661)	8	8	0.85	65	35	44.9	52.3	33.6	43	54	45.5	19.6	8.7
Wholesale and Retail (n=39-536)	4	9	0.47	69.2	30.8	25.6	35.6	36.8	40.1	41	15.3	6.6	6.1
Transportation and Storage (n=21-230)	4	11	0.59	81	19	27	36.1	31.3	33	31.7	12.7	7.5	7.6
Information and Communication (n=42-180)	17	91	0.99	76.2	23.8	55	50.6	51.7	52.8	39.4	47.3	15	11.1
Financial and Insurance Activities (n=37-236)	7	7	0.85	73	27	33.9	46.6	35.2	48.7	29.7	22.2	13.8	11.3
Scientific and Technical Activities (n=14-136)	5	29	0.70	71.4	28.6	26.5	32.4	33.8	41.9	39.7	24.4	11.7	11.4

All percentages are valid percentages, accounting for the missing data

[a] - Average of the sum of a firms' turnover from new to market products and turnover of new to firm products

[b] - Average of firms' innovation expenditure divided by the firms' turnover

[c] - Co-operation breadth - number of the different types of domestic and foreign co-operation partners firms' use in their innovation process

Interviews analysis

Innovation is practiced as a structured process at the studied food firms. Owing to the growing competition and with the belief that being innovative in their offerings is one of the ways firms can sustain in the market place, innovation is being given great importance at the firms and is practiced as a formal activity; formal in terms of allocation of money for carrying out innovation and formation of designated teams who engage in regular meetings for managing the activity. It however is noteworthy that regardless of the presence of a defined innovation team and dedicated innovation budget, it is the marketing department at the firms that drives and spear heads the innovation activity. Thus, innovation though gaining importance and increasingly being rooted in all functioning of the firms, the onus of carrying out and managing the process lies on the marketing department.

The objectives with which innovation is carried out varies from firm to firm, and for managing their innovation activities for meeting these objectives, firm engage in measuring the effectiveness of their innovations so as to keep a tab of how well they are faring on the innovations they do and how can they be better managed. It may be emphasised that though the range of objectives that firms have for achieving through their innovations is wide, the manner in which they gauge their innovations' value is predominantly in terms of sales achieved. The results from case data are summarized in Table 2.

Evidences collected through interviews about a significant innovation in four medium-sized (€85m to €300m) and four large (716m - €5,800m) firms from the food sector in Ireland, when analysed in the light of the IVC, highlight the following findings.

Idea generation: The most interactive stage of the innovation process

The first phase or the idea generation stage was the most interactive stage for all the firms studied. At this stage the firms' engagement with external parties ranged from their interactions with their customers, suppliers, consumers, to market research agencies and consultancies. However, these interactions were primarily confined to gathering market insights. The firms' interactions with its consumers were to understand their requirements, their expectations and feedback about its products. Customers, suppliers and market research agencies were contacted largely to develop insights about the trends in the market so as to inform their idea generation process and innovative offerings. In a few cases though, firms were beginning to move beyond gathering market insights and experimenting with the concept of co-creation with their consumers and customers.

Table 2. Cases Summary

Themes	Firms	Inference
Innovation Objectives		Innovation objectives vary from firm to firm
Entering new market	A, B, C, D and E	
Extending product portfolio	B, C, D and E	
Becoming market leader/ Maintaining market position	E, F and G	
Staying ahead of competition	B and D	
Meeting customer's/consumer's demands	F and G	
Increasing market share	B	
Improving quality	B	
Reducing cost	B	
Innovation Structure		Marketing department drives innovation
Innovation teams	A, B and D	
New Product Development team / Task forces / Cross functional teams headed by marketing department	C, E, F, G and H	
Innovation Budget		Marketing department drives innovation
Allocate innovation budget	C, E, G and H	
Allocate separate budget for each innovation stage	D	
Marketing budget used for innovation	A, B and F	
Measure of Innovation Effectiveness		Value of innovation measured in sales terms
Matrices used:		
Revenues or new sales generated	A, B, C, D, E, F, G and H	
Market impact the innovation creates	D, E and H	
House hold penetration	F and G	
Market Focus		All business functioning based on market insights
Market Focused	A, B, C, D, E, F, G and H	
Internal Interactions		Flexible internal interactions facilitated by regular meetings
Smooth internal interactions	A, B, C, D, E, F, G and H	
External Interactions		Limited external interactions Based on relationship with external parties More inbound exchanges than outbound
With:		
Customers	A, B, C, D, E, F, G and H	
Suppliers	A, C, E, F, G and H	
Consumers	E	
Consulting agencies	A, B, C, D, E, F, G and H	
Competitors	B, C, D, E, F, G and H	

Medium sized firms – A, C, F, G
Large sized firms – B, D, E, H

Competitive threat limits firms' openness when developing innovations

The second stage or the conversion stage of the IVC is more or less an in-house development stage in the studied firms, primarily marked by internal interactions amongst cross departmental teams. At this stage the firms' new product development, marketing, technical, supply chain, procurement, finance, sales, quality control etc. teams work together to develop the innovation, involving manufacturers, suppliers and customers as and how the need arises. The external interactions at this stage in the firms apart from being limited are also very carefully managed. The firms refrain from divulging detailed information about their innovations as their suppliers or manufactures also cater to their competitors. Competitive threats limit the extent of external interactions the firms engage in at this stage and openness in their innovation activities is least adopted by the firms at the conversion stage of the innovation value chain.

Innovation diffusion with customer collaboration

Although it is the firms' internal teams that work towards bringing the innovation to the market, firms also interact with its customers or retail partners for launching the innovation output. The firms open up their innovation activity by collaborating with these external parties to diffuse their innovation into the market. Few firms also engage with brand activation agencies and advertising agencies at this stage to promote their innovation. While openness with regard to engagement with retail partners is the main focus at the commercialization stage of the value chain, for feedback on their innovations' consumer acceptability and performance the firms' also rely on market research agencies. This stage of the value chain presents evidences of open interactions with external parties, primarily retail partners, with the focus of launching the innovation in the market and getting feedback on its performance.

Ad hoc and conscious adoption of OI practices by small and large firms respectively

In terms of the process of adoption of OI practices, the smaller firms in the study engaged in more ad hoc adoption of OI practices. These firms are opening up their innovation processes only for certain innovations or activities. For example one firm prefers opening up only to its sister firms for its innovations while others consider opening up a challenge and engages in it only when they lack certain expertise and it is not disadvantageous to their market image. The larger firms in the study display evidence of more conscious adoption of open innovation, practicing the activity more holistically and regularly. One of the firms for instance is engaging with its end customers with the idea of co-creation for its innovative offerings and another regularly works with its retail partners when developing its innovations. Thus the pattern of OI adoption and practice is more impromptu in case of small firms against the conscious adoption by the larger firms.

Managers regard external interactions for market orientation as being open in their innovation processes

Being highly market oriented, devoting time and resources for gathering market insights for development of new innovations or for improving upon their offerings, firms constantly focus on developing an understanding about customers' requirements and preferences as well as on getting feedback on their products and services As this requires interaction with their customers, consumers, suppliers, manufacturers etc., people who are external to their firm, managers believe firms engage in OI practices. They are also of the opinion that because these external interactions have always been a part of their regular functioning, adoption of OI practices to the extent they practice now cannot be regarded as a major shift in strategy.

5. Discussion and conclusions

This paper adopts a firm level perspective to analyse the adoption of OI practices. In particular, it uses established concept like the innovation value chain to look into the extent of adoption of OI by firms from the food sector in Ireland, developing an emerging work that explores the adoption of OI in a non-high tech context. The analysis shows that food is one of the more innovative sectors in Ireland with a focus on research and development activities. However adoption of OI practices as indicated by its engagement and collaboration with external partners is rather low, with most firms engaging with few external partners. These findings support and add to the earlier research on Irish firms in general having a low degree of openness as measured by the number of external collaborations (Vahter et al., 2012).

The descriptive findings indicate that within the low co-operation breadth, the external partners food firms most engage with are their suppliers and customers. These findings are in line with recent research evaluating the role of different external partners in the practice of OI which regard customers and suppliers as the key contributors (Hienerth, 2006); (Laursen and Salter, 2006); (Von Hippel, 1986).

A possible explanation of these findings along with an understanding about the adoption of OI practices during the innovation process and perceptions influencing the adoption emerged from the analysis of the interviews. A systematic analysis of the IVC for interactions across it as the firms develop their innovations highlights that the firms engage in interactions with external parties at all stages across the value chain but the nature and extent of these interaction varies at the different stages. The idea generation stage involves maximum external interactions because firms intend to have the best of market knowledge before undertaking an innovation. They thus engage with customers, suppliers and market

research agencies to develop insights about market trends to develop and refine their idea generation process and innovative offerings. While the innovation development stage is the most concealed phase of the innovation process owing to the fear of competition the final launch stage is characterised by external interactions particularly the customers. This is because at this stage, firms again aim to take advantage of their retail partners' insights about consumer preferences and to get feedback on their innovations' performance. The analysis thereby outlines that stage of the innovation process, in terms of the IVC, influences the adoption of OI practices.

For all the stages however, customers and suppliers are the preferred partners for open interactions. This is possibly because they are the primary and most important source for gathering market insights and gathering market insights is practicing OI from the perceptions of managers. Firms constantly focus on developing an understanding about customers' requirements and preferences as well as on getting feedback on their innovative products and service. They believe that in doing so they interact with their customers, consumers and suppliers etc. and as such they are opening their innovation activities.

It may be highlighted here that market orientation is defined as the process by which firms generate market intelligence regarding the current and future needs of the customers, their capacity to disseminate the gathered information within the firm and to rapidly respond to the needs of the market (Kohli and Jaworski, 1990). To this effect, firms need to engage in interactions with external parties, like their customers, consumers and suppliers etc. and thus be open. However opening innovation spans beyond just customer involvement for gathering market information. It involves the firm using external knowledge to improve its own internal innovation process. More specifically, OI can be defined as 'the proportion of innovations generated in cooperation / collaboration with universities, research organisations, customers and / or suppliers, other companies, venture capitalists and industry / cluster associations or business assistance centres as opposed to innovations that are entirely generated within the company' (Chesbrough et al., 2006). Market orientation can therefore be regarded as a subset of OI as is suggested by evidences in the data.

The interview data also presents evidence of managerial perceptions about innovation and OI that impact and limit the adoption of OI practices by food firms in Ireland. While literature outlines how managerial perceptions play a role in innovation adoption (Geroski, 2000), this study presents evidences that the adoption of open innovation is also largely impacted by managers believes. The extent to which firms open up in their innovation activities is limited owing to managers' perceptions that apart from market information they have little to gain either in terms of knowledge or resources in an open interactive scenario. While concepts such as not invented here syndrome with regard to external interactions in innovation are discussed in the literature (Katz and Allen, 1982), the study highlights managerial perceptions about losing credibility and competitive advantage in the market upon opening up their innovation.

Additionally managers are of the opinion that OI is beneficial for smaller players in the market, who could learn and gain by interacting with the established big players as their own capabilities are limited, sensitivities less and they can be more adaptable. The data however does not present any direct evidence to highlight this difference in benefits as suggested by the managers. Although, it does indicate that smaller firms of the sample display a more ad hoc adoption of open practices than the larger firms which adopt them more holistically and regularly, thus indicating that smaller firms tend to be less open than larger firms. Possibly because of difficulties in achieving compatibility with established big firms. These findings are in line with recent research evaluating differences in openness of small and large firms (Vahter et al., 2012).

Implications of the study

The paper contributes to the OI literature by outlining that adoption of OI practices differs with the stage of the innovation process. That the relative low levels of 'openness' in the innovation process is reflective of managerial perceptions about the activity of open interactions and highlights how managerial perceptions of external competitive threats shape the extent of 'openness' in the innovation process. From the perception of managers, market orientation can be regarded as a subset of open innovation.

With regard to managerial implications, the paper with the empirical basis that it discusses provides managers with a number of insights on their perceptions about innovation and OI that can be useful in assessing their implications towards adoption of the OI paradigm.

Limitation of the study and suggestions for future research

The paper has a number of limitations that calls for future research. Firstly as the methodology that it uses, the results cannot be generalized to other sectors/industries with characteristics different from the studied food sector. Future research is therefore required to investigate, may be by comparative multiple case studies as to how adoption of OI across the IVC varies across industries. Additionally longitudinal large scale research design may shed more light on the factors influencing the adoption of OI practices along the IVC.

6. References

Agarwal, S., Erramilli, M.K., Dev, C.S. (2003) Market orientation and performance in service firms: role of innovation, *Journal of Services Marketing*, **17**, 1, 68-82.

Audretsch, D.B., Menkveld, A.J., Thurik, A.R. (1996) The decision between internal and external R&D, *Journal of Institutional and Theoretical Economics*, 152, 2, 519-530.

Bianchi, M., Cavaliere, A., Chiaroni, D., Frattini, F., Chiesa, V. (2011) Organisational modes for open innovation in the bio-pharmaceutical industry: An exploratory analysis. *Technovation*, **31**, 1, 22-33.

Cassiman, B. and Veugelers, R. (2002) R&D cooperation and spillovers: some empirical evidence from Belgium. *American Economic Review*, **92**, 4, 1169-1184.

Chesbrough, H. and Crowther, A.K. (2006) Beyond high tech: early adopters of open innovation in other industries. *R&D Management*, **36**, 3, 229-236.

Chesbrough, H., Vanhaverbeke, W., West, J. (2006) *Open innovation: Researching a new paradigm*, Oxford: Oxford University Press.

Chesbrough, H.W. (2003a) The era of open innovation. *Managing innovation and change*, **127**, 3, 34-41.

Chesbrough, H.W. (2003b) *Open innovation: The new imperative for creating and profiting from technology*, Boston: Harvard Business Press.

Chiaroni, D., Chiesa, V., Frattini, F. (2010) Unravelling the process from closed to open innovation: evidence from mature, asset intensive industries. *R&D Management*, **40**, 3, 222-245.

Chiaroni, D., Chiesa, V., Frattini, F. (2011) The open innovation journey: How firms dynamically implement the emerging innovation management paradigm. *Technovation*, **31**, 1, 34-43.

Christensen, J.F., Olesen, M.H., Kjær, J. S. (2005) The industrial dynamics of open innovation—Evidence from the transformation of consumer electronics. *Research Policy*, **34**, 10, 1533-1549.

Dodgson, M., Gann, D., Salter, A. (2006) The role of technology in the shift towards open innovation: the case of Procter & Gamble. *R&D Management*, **36**, 3, 333-346.

Doran, J. and O'leary, E. (2011) External interaction, innovation and productivity: an application of the innovation value chain to Ireland. *Spatial Economic Analysis*, **6**, 2, 199-222.

Eisenhardt, K.M. and Graebner, M.E. (2007) Theory building from cases: opportunities and challenges. *Academy of Management Journal*, **50**, 1, 25-32.

Enkel, E., Gassmann, O., Chesbrough, H. (2009) Open R&D and open innovation: exploring the phenomenon. *R&D Management*, **39**, 4, 311-316.

Ferrary, M. (2011) Specialized organizations and ambidextrous clusters in the open innovation paradigm. *European Management Journal*, **29**, 3, 181-192.

Gassmann, O., Enkel, E. and Chesbrough, H. (2010) The future of open innovation. *R&D Management*, **40**, 3, 213-221.

Geroski, P.A. (2000) Models of technology diffusion. *Research Policy*, **29**, 4, 603-625.

Hansen, M.T. and Birkinshaw, J. (2007) The innovation value chain. *Harvard Business Review*, **85**, 6, 121.

Henttonen, K., Pussinen, P. and Koivumäki, T. (2012) Managerial perspective on open source collaboration and networked innovation. *Journal of technology management & innovation*, **7**, 3, 135-147.

Hienerth, C. (2006) The commercialization of user innovations: the development of the rodeo kayak industry. *R&D Management*, **36**, 3, 273-294.

Huizingh, E. K. (2011) Open innovation: State of the art and future perspectives. *Technovation*, **31**, 1, 2-9.

Huston, L. and Sakkab, N. (2006) Connect and develop. *Harvard Business Review*, **84**, 3, 58-66.

Jordan, D. and O'leary, D. (2008) Is Irish innovation policy working? Evidence from Irish technology businesses. *Journal of the Statistical & Social Inquiry Society of Ireland*, **37**, 1-44

Katz, R. and Allen, T.J. (1982) Investigating the not invented here (NIH) syndrome: A look at the performance, tenure, and communication patterns of 50 R & D Project Groups. *R&D Management*, **12**, 1, 7-20.

Keupp, M.M. and Gassmann, O. (2009) Determinants and archetype users of open innovation. *R&D Management*, **39**, 4, 331-341.

Kirschbaum, R. (2005) Open innovation in practice. *Research-Technology Management*, **48**, 4, 24-28.

Kline, S.J. and Rosenberg, N. (1986) An overview of innovation. In Kline, S.J. and Rosenberg, N. (eds), *The Positive Sum Strategy: Harnessing Technology for Economic Growth*, Washington DC: National Academic Press, pp. 275-305.

Kohli, A.K. and Jaworski, B.J. (1990) Market orientation: the construct, research propositions, and managerial implications. *The Journal of Marketing*, **54**, 2, 1-18.

Laursen, K. and Salter, A. (2006) Open for innovation: the role of openness in explaining innovation performance among UK manufacturing firms. *Strategic Management Journal*, **27**, 2, 131-150.

Lichtenthaler, U. (2008) Open innovation in practice: an analysis of strategic approaches to technology transactions. *Engineering Management, IEEE Transactions on,* **55**, 1, 148-157.

Lichtenthaler, U. and Ernst, H. (2009) Opening up the innovation process: the role of technology aggressiveness. *R&D Management*, **39**, 1, 38-54.

Love, J.H. and Roper, S. (2001) Location and network effects on innovation success: evidence for UK, German and Irish manufacturing plants. *Research Policy*, **30**, 4, 643-661.

Melese, T., Lin, S.M., Chang, J.L., Cohen, N.H. (2009) Open innovation networks between academia and industry: an imperative for breakthrough therapies. *Nature Medicine*, **15**, 5, 502-507.

Morgan, L. and Finnegan, P. (2010) Open innovation in secondary software firms: an exploration of managers' perceptions of open source software. *ACM SIGMIS Database*, **41**, 1, 76-95.

Mortara, L. and Minshall, T. (2011) How do large multinational companies implement open innovation? *Technovation*, **31**, 10, 586-597.

O'Connell, D. (2011) *Harvesting external innovation: managing external relationships and intellectual property*, Aldershot: Gower Publishing, Ltd.

Rigby, D. and Zook, C. (2002) Open-market innovation. *Harvard Business Review*, **80**, 10, 80-93.

Roper, S. (2001) Innovation, networks and plant location: some evidence for Ireland. *Regional Studies*, **35**, 3, 215-228.

Roper, S., Du, J., Love, J.H. (2008) Modelling the innovation value chain, *Research Policy*, **37**, 6, 961-977.

Schmidt, T. (2010) Absorptive capacity: one size fits all? Firm-level analysis of absorptive capacity for different kinds of knowledge. *Managerial and Decision Economics* **31**, 1, 1-18.

Vahter, P., Love, J.H., Roper, S. (2012) *Openness and innovation performance: are small firms different*? Coventry: Warwick Business School.

Van De Vrande, V., De Jong, J.P.J., Vanhaverbeke, W., De Rochemont, M. (2009) Open innovation in SMEs: Trends, motives and management challenges. *Technovation*, **29**, 6, 423-437.

Von Hippel, E. (1986) Lead users: a source of novel product concepts, *Management Science*, **32**, 7, 791-805.

Yin, R.K. (2009) Case study research: Design and methods (vol. 5). Washington D.C: Sage Publications, Inc.